

# **International Space Station Active Thermal Control Sub-System On-Orbit Pump Performance and Reliability Using Liquid Ammonia as a Coolant**

**Richard D. Morton**

NASA Lyndon B. Johnson Space Center

**Matthew Jurick**

**Ruben Roman**

The Boeing Company

**Gary Adamson**

**Chinh T. Bui**

**Yvon J. Laliberte**

Hamilton Sundstrand Space Systems International, Inc

## **Abstract:**

The International Space Station (ISS) contains two Active Thermal Control Sub-systems (ATCS) that function by using a liquid ammonia cooling system collecting waste heat and rejecting it using radiators. These subsystems consist of a number of heat exchangers, cold plates, radiators, the Pump and Flow Control Subassembly (PFCS), and the Pump Module (PM), all of which are Orbital Replaceable Units (ORU's). The PFCS provides the motive force to circulate the ammonia coolant in the Photovoltaic Thermal Control Subsystem (PVTCS) and has been in operation since December, 2000. The Pump Module (PM) circulates liquid ammonia coolant within the External Active Thermal Control Subsystem (EATCS) cooling the ISS internal coolant (water) loops collecting waste heat and rejecting it through the ISS radiators. These PM loops have been in operation since December, 2006.

This paper will discuss the original reliability analysis approach of the PFCS and Pump Module, comparing them against the current operational performance data for the ISS External Thermal Control Loops.